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October 11, 2019

Via Electronic Filing

The Honorable Jocelyn G. Boyd
Chief Clerk/Administrator
Public Service Commission of South Carolina
101 Executive Center Drive, Suite 100
Columbia, SC 29210

RE: South Carolina Energy Freedom Act (H.3659) Proceeding to Establish Dominion Energy South Carolina, Incorporated's Standard Offer, Avoided Cost Methodologies, Form Contract Power Purchase Agreements, Commitment to Sell Forms, and Any Other Terms or Conditions Necessary (Includes Small Power Producers as Defined in 16 United States Code 796, as Amended) - S.C. Code Ann. Section 58-41-20(A)
Docket No. 2019-184-E

Dear Ms. Boyd:

Please find attached for electronic filing the *Surrebuttal Testimony* of Derek P. Stenclik filed on behalf of the South Carolina Coastal Conservation League (CCL) and Southern Alliance for Clean Energy (SACE) in the above-referenced matter.

Please contact me if you have any questions concerning this filing.

Sincerely,

s/ Stinson W. Ferguson

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Attorney for South Carolina Coastal Conservation League and Southern Alliance for Clean Energy

CERTIFICATE OF SERVICE

I hereby certify that the parties listed below have been served via electronic mail with a copy of the *Surrebuttal Testimony* of Derek P. Stenclik filed on behalf of the South Carolina Coastal Conservation League and Southern Alliance for Clean Energy.

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This 11th day of October, 2019.

s/ Lauren Fry
Lauren Fry

STATE OF SOUTH CAROLINA

BEFORE THE PUBLIC SERVICE COMMISSION

DOCKET NO. 2019-184-E

In the Matter of:	)	
	)	
South Carolina Energy Freedom Act (H.3659) Proceeding to Establish Dominion Energy South Carolina, Incorporated's Standard Offer, Avoided Cost Methodologies, Form Contract Power Purchase Agreements, Commitment to Sell Forms, and Any Other Terms or Conditions Necessary (Includes Small Power Producers as Defined in 16 United States Code 796, as Amended) - S.C. Code Ann. Section 58-41-20(A)	)	DIRECT TESTIMONY OF DEREK P. STENCLIK ON BEHALF OF SOUTH CAROLINA COASTAL CONSERVATION LEAGUE AND SOUTHERN ALLIANCE FOR CLEAN ENERGY

Q: Please state your name, position, and business address for the record

A: My name is Derek Stenclik and I am President of Telos Energy, Inc. My business address is 475 Broadway, Unit 6, Saratoga Springs, NY 12866.

Q: Have you previously submitted direct testimony in this docket?

A: Yes. I previously submitted direct testimony discussing Dominion Energy South Carolina's ("DESC") proposed Variable Integration Charge ("VIC") and the Cost of Variable Integration Study, ("Variable Integration Study") conducted by Navigant Consulting which DESC put forth in support of the proposed VIC.

Q: What is the purpose of your testimony?

A: The purpose of my surrebuttal testimony is to respond to the rebuttal testimony of Dr. Matthew W. Tanner, Eric H. Bell, James W. Neely, John H. Raferty, and Thomas E. Hanzlik ("DESC Witnesses") filed on behalf of Dominion Energy South Carolina.

Q: Please explain how you organize your responses.

A: My surrebuttal testimony starts with an introduction which addresses certain issues raised by multiple witnesses listed in the question above. The remaining surrebuttal testimony sequentially addresses certain issues raised by each witness as they appear in his rebuttal testimony.

I. Introduction and general remarks to filed rebuttal testimony

Q: In the rebuttal testimony of Mr. Bell and Mr. Hanzlik, both seem to suggest that your testimony advocates for operating a system without any operating reserves. How do you respond to this characterization?

A: Throughout my career I have led or supported over a dozen large, muti-year renewable integration studies across North America and globally similar in scope to the Variable Integration Study. These studies included evaluation and development of operating reserve requirements for wind and solar. I have also helped develop reserve requirements for multiple utilities. My testimony did not advocate for an abandonment of all operating reserves. I understand there may be

a need for operating reserves to integrate wind and solar if appropriately quantified.

However, I also understand the monetary and environmental costs associated with overly conservative reserve requirements and requirements based on imprecise assumptions like the ones proposed by DESC. There is often a tradeoff between additional reliability and economic efficiency which must be balanced appropriately for the ratepayer. Overly stringent reserve requirements could burden ratepayers, lead to unnecessary operating costs, and limit the growth of the solar industry with only marginal or no benefits to overall reliability.

Q: On Page 11, Line 7 Mr. Hanzlik states that "Mr. Stenclik seems to ignore how NERC ensures the reliability of our nation's electric grid and the enforcement of its Standards." Similar statements are made in the testimony of the other DESC Witnesses listed previously. Is Witness Hanzlik's characterization accurate?

A: No. Mr. Hanzlik's characterization is a misrepresentation of my testimony. I want to clearly articulate that my testimony does not advocate a shift of risk to neighboring utilities, a desire for DESC to "ride the lines" of the Eastern Interconnect, or ignore the importance of NERC standards. Rather, my testimony correctly identified allowable operations within the NERC standards and identified the benefits of a large interconnected grid. It also clearly advocated for a coordinated approach to managing solar variability with neighboring balancing areas. There are four points I would like to make regarding neighboring utilities

and NERC reliability standards discussed throughout the DESC Witnesses' rebuttal testimony:

1. DESC is not an electrical island. It is interconnected with many neighboring utilities and balancing areas. Electricity can and does flow regularly between these areas. DESC can, and regularly does, contract with neighboring entities for energy supply and reserves. Modeling the DESC grid in isolation, as evaluated in the Variable Integration Study, misrepresents this daily reality, removes a highly economic form of system flexibility, and ignores an important mitigation for solar integration which has been clearly identified and implemented by other utilities around the world for many years.

2. NERC reliability standards recognize that perfect balancing of interchange with neighboring BAs is neither possible, expected, nor necessary. These requirements allow for some level of short-term inadvertent flows between utilities. Assuming that DESC must immediately cover 99% of all solar forecast errors, and do so locally, is simply not true. A short-term change in Area Control Error for very rare forecast errors can be corrected without burdening neighboring BAs or threatening reliability. This amount of reserves is overly stringent and would add undue costs to the ratepayer.

3. Neighboring balancing areas are an asset, not a liability. My testimony did not advocate DESC to push their challenges on their neighbors, but rather coordinate with them further. Other neighboring utilities are undergoing the same changes on their system and are challenged with solar variability and uncertainty. It would be far more economic and in the ratepayers' best interest, to tackle these

challenges collectively rather than independently. When spread over large areas and multiple balancing authorities, solar variability and uncertainty is significantly reduced, and a larger pool of reserve assets become available.

There is a long history and precedence for this type of coordination. Today there are many contingency reserve sharing groups across the country (including VACAR which DESC is a member of). In addition, the foundational element of ISOs and RTOs is the recognition that the pooling of resources and reserves is more economic. CAISO recently implemented the Energy Imbalance Market, which combines participation across both vertically integrated utilities and deregulated utilities, as their primary tool to integration of renewable energy. Reserve sharing and coordination is the economically responsible behavior for the ratepayer, regardless of the market structure. While this type of coordination will undoubtedly take time to develop, it is certainly reasonable during the 13-year study horizon evaluated.

I will add that this coordination does not necessarily require a reserve sharing agreement. By simply increasing bilateral energy transactions with neighboring utilities, DESC can "free up" their own generation (allowing their generators to back down to lower loading levels) to provide reserves instead of energy. There is already a long history of these energy transactions and it is a regular part of DESC's operations. This mitigation could be introduced today.

4. Finally, my testimony did not diminish the value of reliability to DESC ratepayers or ignore NERC reliability standards. Rather the DESC Witnesses misunderstood my comments stating that the loss of solar generation would not

pose a reliability challenge. I discussed that under the levels of solar penetration evaluated by DESC, a grid-wide blackout and loss of load is highly unlikely, even if all the solar were to drop off the system simultaneously. This discussion in my original testimony was used to characterize the risk associated with reserve shortfalls. Rather than a grid outage event and customer disruption, a shortfall could lead to a potential violation of NERC standards and a potential fine. This is an important distinction when evaluating the tradeoff between risks and costs associated with reserve requirements. If a grid blackout were feasible, there should be significantly less risk tolerance.

DESC's analysis and testimony overstates the threats to reliability when solar is added to the grid. A grid outage event caused by solar forecast error is extremely unlikely. Instead, this is a challenge of meeting NERC standards. It is important that regulators and ratepayers properly understand the level of risk associated with grid planning decisions so that they can appropriately balance tradeoffs between reliability and costs.

II. Response to Witness Tanner's rebuttal testimony

Q: On Page 9, Lines 6 through 9, Dr. Tanner states that his analysis correctly analyzed solar data because it relied on U.S. Government's National Renewable Energy Lab (NREL) data sets. How do you respond to this rebuttal?

A: While Dr. Tanner's study utilized an accepted data set provided by the U.S. Government's National Renewable Energy Lab (NREL), he analyzed the data using assumptions that were overly conservative. For example, the Variable Integration Study assumed that 99% of all solar drops had to be covered by

operating reserves, whereas other studies, including NREL's Western Wind and Solar Integration Study, Eastern Renewable Generation Interconnection Study, and North American Renewable Integration Study - which were the original purpose of the aforementioned data sets - used a 95% confidence interval. While this may seem small, the outlier data (i.e. the most extreme forecast errors located at the 98 to 99th percentiles) drive much of the overall reserve requirements.

Q: On Page 9, Lines 10 through 12, Dr. Tanner states that his analysis correctly analyzed the benefits of geographic diversity. Is this true?

A: No. While geographic diversity was mentioned in the study, it did not go far enough. Rather it evaluated geographic diversity of the 4-hour ahead solar forecast across *only four* sites in the DESC service territory (emphasis added). In reality, solar will be developed across dozens of sites and thousands of rooftops. I agree with Dr. Tanner's conclusion that "It is critical to incorporate geographic diversity in an integration cost study because it has the effect of reducing the total amount of uncertainty facing DESC. Without considering geographic diversity, the estimated integration costs would be too high." However, additional geographic diversity should be included to represent the spatial reality of DESC's system.

Q: On Page 9, Lines 18 through 19, Dr. Tanner states "Combined cycle gas units can provide reserves as long as they are operating. They are not allowed to provide reserves when they are offline." Does this statement accurately

reflect the capability of those units to provide reserves within the four-hour forecast?

A: No. In fact, the statement supports my original testimony. If combined cycle units can start within two hours, as confirmed by DESC in a data request response, a shorter forecast should be used.[1] A shorter forecast horizon could significantly reduce the reserve requirement and associated cost. If the forecast horizon is limited by the data available in the NREL data set, then the combined cycle units should be counted as providing reserves even when offline. By allowing either for a shorter forecast window or combined cycles to be counted for reserves, the study would accurately quantify the costs of providing reserves, maintain reliability, and properly value the flexibility of combined cycle generators.

Q: On Page 10, Lines 12 through 15, Dr. Tanner states that "Because of the amount of capacity that is available at night, requiring additional reserves at night does not materially change system economics and to the extent any change occurs at all." How do you respond to Dr. Tanner's assertion that hourly reserve modeling is not required?

A: This statement is not true and highly misleading. For one, it cannot be quantified or verified due to limitations of the simulation tool used in Dr. Tanner's analysis. Second, in Dr. Tanner's original exhibit (Figure 9, Page 25), he

[1] DESC Response to South Carolina Coastal Conservation League and Southern Alliance for Clean Energy First Data Request 1-13, SC PSC Docket No. 2019-184-E (confirming a previous response to SACE and CCL DR 3-14 dated February 15, 2019, in Docket No. 2019-2-E remains accurate).

provided a distribution of "Reserve Shortfalls by Hour in All Solar Case." This figure included many reserve shortfall events before 9 AM and after 6 PM, which would constitute low, or zero, solar output. These time periods would require no additional solar reserves. This is especially true in the winter when the system's most challenged operations occur during the early morning load ramp and evening peak, outside of daylight hours. However, these hours were evaluated by Dr. Tanner with the same amount of reserves as mid-day hours. Through these errors, the modeling conducted by Dr. Tanner added cost to the system during overnight hours and attributed that cost to solar generators.

Finally, the blending method suggested by Dr. Tanner to account for this is not standard industry practice. Production cost modeling tools such as GE MAPS and PLEXOS have been used for many, if not most, of North America's largest variable renewable integration studies and are capable of simulating hourly reserve requirements. Hourly simulation of reserve requirements is a standard approach implemented in renewable integration studies and the Cost of Variable Integration Study should be no different.

Q: On Page 11, Lines 16 through 21, Dr. Tanner testifies that the Variable Integration Study correctly evaluated other technologies and operating practices to provide reserves. How do you respond?

A: The Variable Integration Study included an overly simplified, inaccurate analysis of other technologies. Dr. Tanner states that the study "looked in depth at the costs for DESC to add a gas-fired peaking facility or storage to the system to

provide flexible reserves for renewable integration." However, the testimony also states that the resources were evaluated "solely" to provide reserves. A battery storage asset, or other new technologies, can provide multiple benefits to the system and should be evaluated in a more holistic way. These services could include firm capacity benefits, energy or energy arbitrage benefits, transmission and distribution deferral, and environmental benefits. Evaluating only reserve provision limits the ability for the resources to be economic based on multiple value streams.

Second, Dr. Tanner's rebuttal testimony stated that larger balancing area coordination "cannot be feasibly done in the short-term. … Implementing a larger balancing area would require multiple years of study and negotiation with surrounding utilities and states." While I agree that developing a larger balancing area or increased coordination would take time to develop, it should be at least evaluated as a potential mitigation in a study horizon that extends over 13 years. In addition, even if neighboring utilities do not share reserves, DESC can purchase energy during time periods of potential reserve shortage, thus freeing up other generating capacity on DESC's system to provide reserves.

Finally, the Variable Integration Study did not evaluate other potential technologies and operating strategies, including new demand response, combined cycle upgrades, and discounting of solar forecasts.

Q: On Page 13, Lines 6 through 9, Dr. Tanner testifies that your testimony conflates regulation reserves and operating reserves and that other grid

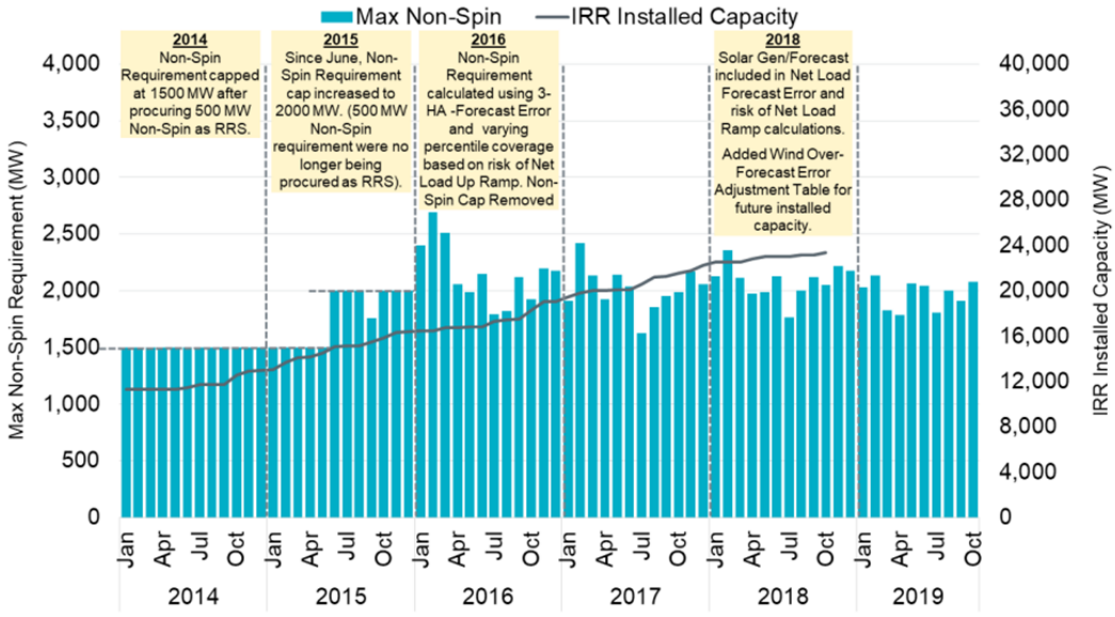
operators have required large increases in reserve requirements with additional solar. How do you respond?

A: My testimony did not conflate different reserve types. It used an example of regulation reserves because the Variable Integration Study regularly discussed the needs to manage solar variability (managed by regulation reserves) and forecast error (managed by operating reserves).To further add evidence to my claim, I am including a figure showing ERCOT's non-spinning reserve requirements, which are used to manage wind and solar forecast errors, to supplement the regulation reserve chart included in my original testimony.

In ERCOT, the non-spinning reserve requirement, which is based on net load forecast error, has also remained flat (when averaged over the year), despite significantly increasing wind and solar resource capacity (note that the observed increase from 2014 to 2015 actually moved 500 MW reserves from the Responsive Reserve Service to the slower non-spinning reserve). It should also be noted that ERCOT uses a shorter forecast wind (3-hours) than DESC's proposal, is based on net load forecast error as opposed to solar only forecast error, and ERCOT is proposing to remove the non-spinning reserve floor to allow a further reduction in non-spinning reserve.[2]

[2] Sandip Sharma, ERCOT, 2019 Methodology for Determining Minimum Ancillary Service Requirements, *available at* http://www.ercot.com/content/wcm/key_documents_lists/137978/9_2019_Methodology_for_Determining_Minimum_Ancillary_Service_Requirements.pdf.

Figure 1: ERCOT Non-Spinning Reserve Requirements Over Time



In addition, my testimony did not claim that other jurisdictions do not utilize reserves to manage wind and solar variability, but rather that other jurisdictions have been able to mitigate the amount of increased reserves as wind and solar has increased significantly – to levels much higher than DESC's proposal both in terms of absolute MW and as a percentage of load. They have done so using a diverse set of mitigations, using a variety of tools, operating techniques and technologies. They did not simply assume a continued addition of more and more operating reserves in isolation. As Dr. Tanner states, both ERCOT and CAISO have "changed market procurement rules or market structures." I believe there are similar adjustments that can be made by DESC to avoid ever-increasing reserves.

III. Response to Witness Bell's rebuttal testimony

Q: On Page 7, Lines 12 through 16, Mr. Bell testifies that DESC's actual operating practice requires additional reserves for solar intermittency. How do you respond?

A: Mr. Bell's rebuttal states that current operating practices include reserves to cover 40% of solar output. This is the first time where this information is stated by DESC in this docket and it appears to be a very recent development.[3] The very recent imposition of increased reserve requirements lends further support to the need for additional study and operational experience prior to imposing a VIC. Adding contractual costs based on reserve requirements that have not been thoroughly established and vetted is premature and would be adding a real cost based solely on a simulated or very newly imposed reserve requirement.

Q: On Page 9, Lines 10 through 15, Mr. Bell testifies that DESC currently uses and will continue to use hourly forecasting and actual solar production to plan and maintain reserves. How do you respond?

A: In my testimony I was concerned with the lack of hourly reserve modeling in Navigant's Cost of Variable Integration report and analysis using PROMOD, which established a variable integration cost for solar resources. Mr. Bell misinterpreted my statements as highlighting limitations in DESC's actual operating practices or avoided cost analysis. However, I did not make any statements regarding the avoided cost analysis or DESC's operations related to

[3] DESC Response to South Carolina Coastal Conservation League and Southern Alliance for Clean Energy Third Data Request 3-1 and 3-2, SC PSC Docket No. 2019-184-E (providing the new 40% reserve requirement as a change in response from data responses provided earlier this year in PSC Docket No. 2019-2-E).

the lack of hourly reserves. Instead I limited my testimony to the Navigant Cost of Variable Integration study which did not use an hourly reserve requirement. The fact that DESC adjusts reserve requirements hourly in real operations, and the avoided cost/benefit calculation, further highlights the limitation in the Navigant Cost of Variable Integration analysis.

Q: On Page 10, Lines 21 through 22, Mr. Bell testifies that DESC and Navigant compared the cost effectiveness of adding storage or quick start units to the VIC calculation. Do you agree with his statements?

A: No, I do not believe that DESC or Navigant accurately or appropriately evaluated quick start units, battery storage, or other potential technologies. As stated in more detail in my response to Dr. Tanner's rebuttal, the analysis evaluated resources "solely" to provide reserves. A battery storage asset, or other new technologies, would provide multiple benefits to the system and should be evaluated in a more holistic way. These services could include firm capacity benefits, energy or energy arbitrage benefits, transmission and distribution deferral, and environmental benefits. Evaluating only reserve provision limits the ability for the resources to be economic based on multiple value streams.

In addition, the Variable Integration Study did not evaluate other potential technologies and operating strategies, including new demand response, combined cycle upgrades, and discounting of solar forecasts.

IV. <u>Response to Witness Hanzlik's rebuttal testimony</u>

Q: On Page 12, Lines 11 through 13, Mr. Hanzlik testifies that sudden spikes in solar generation greatly impact frequency. Do you agree with his statements?

A: No. I believe these statements mischaracterize system risks associated with solar. While this could be true on some grids or with high enough solar penetration, it is not true in this case. This is because system frequency is supported by the inertia and automatic response from thousands of generating units across the Eastern Interconnect, which stretches from North Dakota to Florida and Maine to Arkansas. Therefore, a change in solar output in South Carolina—even at the highest levels evaluated in this study—appears very small given the size of the rest of the Eastern Interconnect and would have little impact to the system frequency. Mr. Hanzlik does not provide any measured frequency data to support his claims. While this concern is prudent for low inertia grids like ERCOT or island systems, it is not a concern for the Eastern Interconnect for the foreseeable future.

Q: On Page 12, Lines 18 through 20, Mr. Hanzlik testifies that "the typical winter load curve begins with a morning peak just prior to sunrise when there is no solar output. During these early morning hours, solar is not available and DESC's non-solar generators are near maximum generation output levels while reserves are at the lowest level for the day." How do you respond?

A: Mr. Hanzlik clearly articulates why an hourly reserve requirement for the solar forecast errors is important in the production cost modeling conducted by Dr. Tanner. A high solar scenario should not add any solar reserves during these

challenging hours because it is known with perfect accuracy that there will be no solar generation before sunrise.

Q: On Page 14, Lines 4 through 6, Mr. Hanzlik claims that coordination and reserve sharing agreements would ignore NERC's overall approach to reliability. Is this correct?

A: No. Mr. Hanzlik incorrectly asserts that DESC could not coordinate with neighboring BAs at all during the 13-year horizon evaluated in this study. My testimony does not claim that DESC could do this immediately, but rather formalize long-term reserve sharing agreements and balancing markets to help mitigate solar variability and forecast errors. This has been successful in other jurisdictions and is a foundational element to ISOs and RTOs. DESC currently participates in VACAR to share contingency reserves with neighboring utilities.

Q: On Page 16, Mr. Hanzlik discusses the utilization of the Fairfield Pumped Storage (FFPS) plant. Please respond to this claim.

A: Mr. Hanzlik misunderstood my testimony, which was solely based on Navigant's simulation and not DESC's actual operating practices. To clarify my testimony further, I made no claims as to whether FFPS' historical or current operations is optimal. Rather I was raising concerns that how the unit was modeled in the production cost modeling tool did not accurately reflect highly flexible real-world capabilities referenced by Mr. Hanzlik. I also did not claim it would be best used solely as a reserve asset.

Q: On Page 20, Mr. Hanzlik shows an illustration of system load and solar for September 9, 2019. Does this figure properly characterize forecast errors?

A: No, I believe it misrepresents solar forecast errors. Mr. Hanzlik's testimony includes an illustrative example of September 9, 2019 solar generation and forecast error showing a large drop in solar generation as the day progresses, despite the forecast assuming a relatively clear day. However, this is misleading as it over-characterizes the large forecast errors in the afternoon hours. In real-time, the operator can adjust to new information. When the solar forecast started to deviate around 11:00 AM, the operator could update the solar forecast to consider new changes in weather to better prepare for the afternoon hours. As my testimony originally suggested, DESC should evaluate implementing a regularly updated rolling forecast horizon.

V. <u>Response to Witness Neely's rebuttal testimony</u>

Q: On Page 32, Mr. Neely states that any delay in including the cost of operating reserves harms DESC's customers. Do you agree with this statement?

A: No. The Navigant Cost of Variable Integration analysis used to develop the VIC has many limitations that should be corrected. Using the values developed in this report would add long-term, incorrectly-calculated contractual costs to solar projects. This would increase the price of solar power in South Carolina on a false basis, thereby denying ratepayers the economic benefit of renewable energy that is actually cost-effective. Ultimately the VIC costs will be

incurred by the ratepayer due to more expensive solar generation and continued use of DESC's fossil generating fleet.

The independent renewables integration study authorized by recent South Carolina legislation would allow for a more transparent and accurate calculation of integration cost that includes stakeholders and additional technical experts. This is a more prudent option—in the short-term DESC can operate with additional reserves if necessary, without burdening renewable energy companies or ratepayers with long-term contractual costs that are not justified.

VI. Response to Witness Raftery's rebuttal testimony

Q: On Page 3, Mr. Raftery states that DESC appropriately included demand response resources in its analysis of Variable Integration Charges. Do you agree?

A: No. Mr. Raftery's rebuttal discusses the work DESC has completed to evaluate new demand response resources. In doing so, he mischaracterizes my testimony. My original testimony did not assert that DESC has not evaluated demand response in general. Rather, my testimony correctly stated that it was not included as a new reserve option in the Navigant Cost of Variable Integration analysis. This study, which was used to calculate the proposed Variable Integration Charge only evaluated new combustion turbines and battery storage. Omission of new demand response resources potentially increases the long-term costs associated with providing reserves.

In addition, Mr. Raftery claims that DESC "conducted an extensive investigation into the possibility of relying on additional demand response

programs to reduce ***peak demand***" (emphasis added). However, this type of demand response is fundamentally different than demand response for operating reserves as it typically requires at least 4-hours of customer load interruption. Demand response for operating reserves can be much shorter, only required until the next unit is turned online. This type of demand response has been introduced commercially at other utilities for variable renewable integration. Evaluating a study across a 13-year horizon without including new demand response resources as a candidate option overstates the cost of providing reserves, especially in future years.

Q: Does this conclude your testimony?

A: Yes.